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1. Title of the Invention: Liquid crystal display panel

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SPECIFICATION

1. Title of the Invention

Liquid crystal display panel

2. Scope of Claim for Patent

5 1. In a liquid crystal display panel utilizing a semiconductor substrate provided with a plurality of active elements and passive elements, said liquid crystal panel characterized in that said semiconductor substrate is provided with electrode films in a matrix form corresponding to said active elements and said passive elements over a surface of the semiconductor substrate, which surface has been planarized, and a surface of said semiconductor substrate is covered with an orientation treatment film.

10 2. The liquid crystal display panel of claim 1, wherein the planarized surface of the semiconductor substrate is formed by coating an insulating material in varnish form at a film thickness of 1 to 5μ on the semiconductor substrate having big irregularity.

15 3. The liquid crystal display panel of claim 1, wherein the orientation treatment film on the surface of the semiconductor substrate is an oblique evaporation film of SiO.

20 4. The liquid crystal display panel of claim 1, wherein the liquid crystal has a twisted nematic structure.

 5. The liquid crystal display panel of claim 1, wherein the liquid crystal comprises polygenetic color and nematic liquid crystal.

"Detailed Description of the Invention"

The present invention relates to a liquid crystal display panel. Further, the present invention relates to a surface configuration and a surface treatment of a semiconductor substrate which is utilized for one of substrates constituting a display cell.

Recently, the display device is extremely advanced. Especially, the display device using liquid crystal has many advantages of low voltage driving, low power, thin type and long life. In these days, it is utilized for various kinds of display devices such as wristwatch, pocket calculator. On the other hand, as a practical uses, the display device is applied for character display and television by making the best use of the above mentioned advantages of the liquid crystal display device. In this way, in case that the number of rows and columns of matrix display is big, it is effective to statically drive a liquid crystal utilizing active elements, which are prepared on a semiconductor substrate as one of the substrates constituting the display cell. The present invention relates to this static drive type liquid crystal display device.

Fig. 1 shows a conventional liquid crystal display panel. Fig. 1 shows a structural drawing of the conventional liquid crystal display panel. Reference numeral 1 in the figure shows a semiconductor substrate comprising active elements or passive elements. A liquid crystal driving electrode 2 is prepared on a surface of a semiconductor substrate in a form of matrix. Reference numeral 5 shows a spacer, and a transparent conductive film 4 is formed on an upper side glass plate 3. Reference numeral 6 shows a liquid crystal. Fig. 2 shows a cross sectional drawing of a semiconductor substrate. In Fig. 2, a region enclosed with two dot chain line equals to one pixel. One transistor and one condenser are included in one pixel. In the figure, reference numeral 7 shows, for example, a n-type silicon substrate, 8 shows a p-type diffused layer, 9 shows a n⁺ type diffused layer, 10 shows a field oxide film, 11 shows an SiO₂ film, 12 shows a doped polysilicon film, and 13 shows a CVD SiO₂ film. 14 is an aluminum film comprising electrode and wiring. 15 is a protective film, which is usually a CVD SiO₂ film. In Fig. 2, the part A is a transistor and the part B is a condenser. As apparent from Fig. 2, in case that the semiconductor substrate is manufactured by a conventional process, a step of approximately 1 to 3 μ is formed on the surface of the semiconductor substrate. The unevenness of the surface is generally large although it depends slightly upon the configuration of the elements embedded in the semiconductor substrate and the manufacturing processes. Therefore, as shown in Fig. 2, when an orientation treatment is

conducted on the surface of the semiconductor substrate having big irregularity by oblique evaporation of SiO or the like, there is formed one surface on which the SiO film is formed and another surface on which no SiO₂ film is formed as shown in Fig. 3. In Fig. 3, 16 is the semiconductor
5 substrate having irregularity on the surface thereof. 17 is a direction of evaporation of SiO particles which are deposited by an oblique evaporation at an angle $\theta = 70$ to 89° and 18 is an SiO film formed on a semiconductor substrate. As apparent from the figure, the bigger the irregularity formed on the surface of the semiconductor substrate 16 is,
10 the smaller the proportion of the surface having the SiO film formed thereon is. If a proportion of the surface having no SiO film is large, this part does not contribute to the actual display. Therefore, the contrast extremely reduces and the function as a display device deteriorates. The present invention removes the defect of the conventional liquid crystal display panel. Referring to the detail examples, the object of the present invention will be set forth in the description.

Usually, the surfaces of two substrates constituting the liquid crystal display panel needs to be treated with a horizontal orientation or vertical orientation treatment depending upon the display mode and the kind of the liquid crystal. There are many methods as an orientation treatment, for example, rubbing process, oblique evaporation, and dipping method using such as silane coupling agent. However, in view of characteristic and homogeneous quality, oblique evaporation process is best. In the oblique evaporation method, SiO or Teflon is evaporated on the substrate in vacuum at an angle of 70 to 89° and thin and long lines are innumerable formed at intervals of several hundreds to several thousands Å(angstrom) on the surface of the substrate in order to conduct the orientation of the liquid crystal. In case of conducting oblique evaporation to glass substrate, an oblique evaporation film 20 is deposited on an entire surface because a
20 surface of a glass plate 19 is flat as shown in Fig. 4. On the other hand, in case that a semiconductor substrate is used, a step of 1.0μ or more is formed on a surface as mentioned above. If a semiconductor substrate having a step of 1.0μ on the surface is subjected to an oblique evaporation at an angle of 80° , an oblique evaporation film is not
25 deposited on a region of 5.8μ at one side of the step portion. The present invention has been made to solve the problem described above, thereby obtaining the display panel having high contrast and the excellent image quality. Concretely, in case that the surface of the semiconductor substrate which contributes to the display is flatten and
30 conduct an oblique evaporation, it characterized that a ratio of portion having no oblique evaporation film is reduced. Fig. 5 shows a cross-section
35
40

al drawing of construction of a substrate having reduced a step on the surface of the semiconductor substrate. Reference numerals 7 to 14 in Fig. 5 corresponds to that in Fig. 2. Reference numeral 21 in Fig. 5 is a layer to flatten the surface of the semiconductor substrate, which is the point of the present invention. Further, as a liquid crystal driving electrode, a transparent conductive film layer or a metal layer 22 is formed on the layer 21. The liquid crystal driving electrode is connected with a lower wiring 14 by through hole. The layer 21 which flattens the surface of the semiconductor substrate may comprise polyimide resin, glass having low melting point, insulating material, or the like. In case that a polyimide resin is used, a polyimide film having a thickness of 1 to 5 μ on the surface of the semiconductor substrate by polyimide varnish and spinner application. In this case, silane coupling agent is applied to a base semiconductor substrate to enhance the adherence between the base film and a polyimide film. Subsequently, it is cured at a temperature of 350 to 550°C. Through holes may be formed by photoetching by using hydrazine solution or NaOH. Then, a liquid crystal driving electrode may be formed. Polyimide is used as a flattening material for the semiconductor substrate because it is superior in heat resistance to other organic resins and it can be formed at a thickness of 10 μ without crack. Furthermore, polyimide is superior in passivation effect. However, the present invention is applied to not only a polyimide film but also a glass having low melting point, for example, a lead glass comprising PbO₂ as a main component, a zinc glass comprising ZnO₂ as a main component or a phosphorus glass comprising P₂O₅ as a main component. If a step of 0.5 μ or less is formed on the surface of the semiconductor substrate after deposition, the above mentioned materials can be sufficient for the present invention. By an oblique evaporation, an orientation film is formed on a surface of the flatten semiconductor formed by the above mentioned process. Thereby, as shown in reference numeral 20 in Figs. 5 and 6, almost all display portions can be treated with an orientation process, so that the contrast of the liquid crystal display panel is remarkably improved and it is possible to obtain a good image of the display panel. In Fig. 6, reference numeral 23 is a semiconductor substrate having a planarized surface, and 24 is a liquid crystal driving electrode. By using the semiconductor substrate having the planarized surface according to the present invention, contrast of the liquid crystal display panel is improved to several times as compared with conventional one.

In the present invention, the substrate having a MOS type transistor is

explained as a semiconductor substrate, however, a substrate having TFTs or a SOS substrate may be used as the semiconductor substrate. Moreover, a semiconductor substrate may be consisting of not only active elements but also passive elements. When a liquid crystal display cell according to the present invention is applied to the liquid crystal display television, it is very effective to obtain a high contrast. In this case, a liquid crystal may be a twisted nematic type having low driving voltage or a nematic liquid crystal is mixed with dichroism color. If a semiconductor substrate having a flatten surface is used, display having an improved contrast can be obtained because the thickness of the liquid crystal can be uniform.

As above mentioned, the present invention relates to the liquid crystal display panel, which is characterized that a surface of the semiconductor substrate used for one side of the display panel is planarized to improve the contrast.

"Brief Explanation of The Drawings"

Fig. 1 illustrates a cross sectional structure of a liquid crystal cell.

Fig. 2 is a cross sectional view showing an irregularity, which is formed on the surface of a conventional semiconductor substrate.

Fig. 3 shows an orientation treatment of a substrate having a big irregularity.

Fig. 4 shows an orientation treatment of a glass having a planarized surface.

Fig. 5 shows a cross sectional view of a semiconductor substrate having a planarized surface in accordance with the present invention.

Fig. 6 shows an orientation treatment of a substrate having a planarized surface.

30	1---semiconductor substrate 3---upper side glass plate 5---spacer 7---n type silicon substrate 9---n+ type diffused layer 11---gate oxide film 13---CVD SiO ₂ film 15---CVD SiO ₂ film	2---liquid crystal driving electrode 4---transparent conductive film 6---liquid crystal 8---p+ type diffused layer 10---field oxide film 12---doped polysilicon film 14---a second layer wiring 16---semiconductor substrate having a big irregularity 17---oblique evaporation direction 18---oblique evaporation film
35	19---glass plate	

- 20---oblique evaporation film
- 21---a layer to make a surface of semiconductor to be planarized
- 22---liquid crystal driving electrode
- 23---semiconductor substrate having a planarized surface
- 24---liquid crystal driving electrode

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れていた。この機にマトリックス表示の行数を大幅に増やすことについた場合、表示セルを構成する一方の基板に加熱伝導素子を用い総面積を大幅に削減すれば電子部品により表面をスマートシングル面にする方法が有効である。玉井明社は、このスマートシングル面基板表示装置を実現するものである。

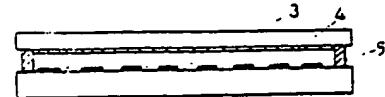
ほどの商品表示がそれを決めるのです。それでこの従来の商品表示が本の構造例を示すものであり、図中の「なまけ太子もしくは愛ね太子」と書かれた部分が本体である。中身は本筋表記には、商品の物語等2がトランジスタ状に配置されてゐる。3はスペーサーであり、上部ガラス板3と下部ガラス板4がおぼされてゐる。6は底面である。第2回は、市場本筋版の新規回である。第2回の二点拍打で消された強波が一海雲に用意する。一方本筋には、トランジスターとコンデンサーがそれぞれ1本づつ含まれてゐる。図中の7は、たとえばカセのシリコン基板、8はド定の歯板を、9はド定の歯板である。10はフィールド強化板。

図のようだが向用のS-LC 域が形成されない場合
が占める割合が大きいと、この部分では導線の表示
に供与したいため、コントラストが著しく低下し、
表示装置としての機能は低下する。本実験はかかる
定規の表示パネルの欠点を取り除いたもの
であり、その目的は、以下具体的な考慮を導入
して現況である。

一般に市販の水バーナーを構成する主要な部品を用いて、液体のみ表示方式、燃費により式子平流向あるいは垂直配向等が必要である。専用電源にはいろいろな方法がある。たとえばラビング法、回路遮断法、シランカッティング断路のディンピング法がそれである。しかし、毒性、燃費の割合などを考慮から、回路遮断法が最も適切。燃費率は 310 カウルの回路遮断を実現して燃費が可として、7.0 ~ 8.5% の燃費で運転せず、本体表面に凹凸 - 斜度 (サンクスストローム) の問題で、回路遮断装置が影響され、燃費が約 10% 増加する。

た六四の爻辞は「貞吉」、全卦に吉を示す。一方
九五は改玉筮を用いる場合、半濟体吉爻は、可成
しむが、其前の爻辭は「勿用」以上にもなり、せ
りに九五の爻辭があつた場合、その爻吉爻と
の衝突から極めて難解である。投票癐の片想を半濟
の筮祓にたまほの医者體が承認されないことになる。
正解出は、この点を解決するためには解されても
のでありシントラストが高くかつ見やすい表示バ
ンルを実現したものである。具体的には矢印は半
濟爻辭が表示に導入する領域の投票癐を示出し、
他の爻辭を示すときも、投票癐によって、他の爻辭
が行はべき推論の与める条件を示すところ
が特徴である。半濟は、半濟体吉爻の矢印が示
さるところを半濟の面積面積である。半濟は中央
アーチを示す条件の場合は、半濟の矢印と対応し
てある。半濟の矢印は、矢印の上部に「半濟」と
矢印の下部に「半濟」の矢印を示す。

1.7 … 塗り墨の方向 1.8 … 塗り墨管
 1.9 … ガラス板 2.0 … 塗り墨管
 2.1 … 半導体基板を平坦化する層
 2.2 … 放電駆動電極
 2.3 … 放電によって硬化された半導体基板
 2.4 … 放電駆動電極



第 1 図

